PATENT ABSTRACTS OF JAPAN

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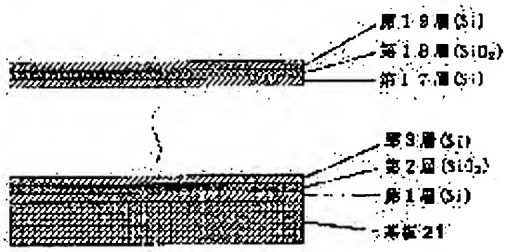
(54) VISIBLE LIGHT SHIELDING AND INFRARED RAY TRANSMITTING FILTER

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain a filter that can be utilized as an IR radiating light source (black light), has a high IR transmittance and a very low visible light transmittance and makes a light source invisible when the light source is seen through the filter.

SOLUTION: High refractive index layers comprising a semiconductor material and low refractive index layers comprising a transparent dielectric are alternately laminated in 17-45 layers on at least one face of an appropriate substrate 21 to obtain the objective filter which shields visible light from a light source and transmits IR by multilayer film interference. The filter has ≥80% average IR transmittance in the range of 900-1,500 nm and ≤0.1% visible light transmittance in the range of 400-800 nm.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

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the examiner's decision of rejection or application converted registration]

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[Patent number]

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CLAIMS

[Claim(s)]
[Claim 1] One [at least] field is made to carry out the laminating of the high refractive-index layer which consists of semi-conducting material, and the low refractive-index layer which consists of a transparence dielectric by turns, while on the rear face of front of a transparence substrate. By multilayers interference It is the filter which intercepts the visible ray from the light source and penetrates infrared radiation. The visible-ray cutoff infrared transparency filter which the number of is 17-45 about the number of cascade screens, and is characterized by being 0.1% or less in within the limits whose permeability of an average of 80% or more and a visible ray is 400-800nm in the range whose infrared permeability is 900-1500nm by stiffness [claim 2] It is the visible-ray cutoff infrared transparency filter [claim 3] of claim 1 characterized by for the above-mentioned semi-conducting material being silicon or germanium, and the quality of the materials of a low refractive-index layer being a silicon dioxide, magnesium flux, etc. The visible-ray cutoff infrared transparency filter [claim 4] of claim 1 characterized by being the infrared exposure light source which cannot check the light source by looking through the above-mentioned multilayers filter, or claim 2 Which visible-ray cutoff infrared transparency filter [claim 5] of claim 1 characterized by arranging the substrate which has the above-mentioned multilayers filter on the surroundings of the whole surface of the light source and a reflector, or the light source thru/or claim 3 Which visible-ray cutoff infrared transparency filter of claim 1 characterized by carrying out the direct laminating of the above-mentioned multilayers filter on a light source bulb thru/or claim 3

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to an infrared filter, especially the filter which intercepts nearly completely transparency of the light used for the light source for an infrared exposure.
[0002]
[Description of the Prior Art] The light is reflected and what carried out the laminating of the metal and semi-conductor which have what carried out the laminating of a high refractive-index transparence dielectric and the low refractive-index transparence dielectric by turns, and the property to reflect the light in the interference filter which penetrates infrared radiation, and the transparence dielectric by turns is known. Among these, the cold mirror which used silicon (Si), a silicon dioxide (SiO2), and/or magnesium fluoride (MgF2) is known as an interference filter which carried out the laminating of a metal and a semi-conductor with the property to reflect the light, and the transparence dielectric, by turns (JP,6-167604,A). This cold mirror is a thing using the property to reflect the light of silicon, and has obtained 20% or less of reflection factor in the infrared region of 80% or more of reflection factor, and 800-2000nm range in the light of 430-675nm range by the laminating of 16 or less layers.
[0003] If absorption of a silicon layer is disregarded when seeing from the reflection factor of the above-mentioned cold mirror and it is going to use this as a filter for the black lights, it can say that it has 80% or more of permeability in the infrared region of 800-2000nm range, and will have 20% or less of permeability in the light of 430-675nm range. When it is going to use this as a filter for the black lights and the light source is seen through a filter, with the naked eye, it spaces and the light source will be in the so-called condition of being visible, and the permeability of the light is too high to use. Although this is also considered that the limitation was generated in design by having made into quarter-wave length optical thickness of each class which constitutes the interference film, it is seen from the purpose of use and considered to be sufficient thing with such a configuration.
[0004]
[Problem(s) to be Solved by the Invention] This invention tends to obtain 0.1% or less of filter an average of 80% or more by within the limits whose permeability of a visible ray is 400-800nm in the range whose infrared permeability which can be used as the infrared exposure light source (black light) is 900-1500nm.
[0005]
[Means for Solving the Problem] The visible-ray cutoff infrared transparency filter of this invention One [at least] field is made to carry out the laminating of the high refractive-index layer which consists of semi-conducting material, and the low refractive-index layer which consists of a transparence dielectric by turns, while on the rear face of front of substrates, such as glass, a quartz, and plastics. By multilayers interference It is the filter which intercepts the visible ray from the light source and penetrates infrared radiation, and the above-mentioned semi-conducting material is silicon or germanium, and the quality of the materials of a low refractive-index layer are a silicon dioxide, magnesium flux, etc., and are characterized by the point which made the number of cascade screens 17-45 layers. And it can consider

as 0.1% or less an average of 80% or more by this configuration in the range whose infrared permeability is 900-1500nm by within the limits whose permeability of a visible ray is 400-800nm, and it becomes possible to acquire the infrared exposure light source which cannot check the light source by looking combining the light source.

[0006]

[Embodiment of the Invention] Drawing 1 is the example which arranged the cylindrical shape filter 2 in the surroundings of the halogen lamp 1 which is the light source, and the laminating of the above-mentioned visible-ray cutoff infrared transparency filter 22 is carried out to the front face of the substrate 21 of the cylindrical shape produced with the ingredient with which this cylindrical shape filter 2 penetrates proper infrared radiation, such as glass, a quartz, and plastics. In this case, a filter may not be prepared in the perimeter side of the light source, but may be prepared only in the front parts of the light source and a reflector. Drawing 3 is the example to which the front face of a halogen bulb 1 was made to carry out the laminating of the above-mentioned visible-ray cutoff infrared transparency filter 22 directly.

[0007]

[Example] Hereafter, ******** of the visible-ray cutoff infrared transparency filter of this invention is shown. In this example, the 19-layer laminating of the high refractive-index layer which consists of silicon, and the low refractive-index layer which consists of a silicon dioxide is carried out by turns, and that cross-section structure is shown in drawing 2 R> 2. Again. The ingredient and optical thickness of each class from a substrate side are shown in Table 1, and the spectral characteristic is shown in drawing 4 .

[Table 1]

基板面から	膜物質	光学膜厚（ｎｍ）
第１層	シリコン（Ｓｉ）	２１．８
第２層	二酸化珪素（SiO_2）	２２８．９
第３層	シリコン（Ｓｉ）	６９．７
第４層	二酸化珪素（SiO_2）	１９９．３
第５層	シリコン（Ｓｉ）	１１２．７
第６層	二酸化珪素（SiO_2）	１７２．１
第７層	シリコン（Ｓｉ）	１４５．７
第８層	二酸化珪素（SiO_2）	１４９．８
第９層	シリコン（Ｓｉ）	１６０．０
第１０層	二酸化珪素（SiO_2）	１５７．５
第１１層	シリコン（Ｓｉ）	１４８．２
第１２層	二酸化珪素（SiO_2）	１５８．９
第１３層	シリコン（Ｓｉ）	１６２．１
第１４層	二酸化珪素（SiO_2）	１４６．０
第１５層	シリコン（Ｓｉ）	１５７．１
第１６層	二酸化珪素（SiO_2）	１５９．１
第１７層	シリコン（Ｓｉ）	１４１．７
第１８層	二酸化珪素（SiO_2）	１６４．２
第１９層	シリコン（Ｓｉ）	９６．６

[0008]

[Effect of the Invention] If the spectral characteristic of the above-mentioned filter is seen, unlike the above-mentioned example of precedence, the visible-ray cutoff infrared transparency filter of this invention has the edge of a very steep transparency band in about 900-850nm, and can acquire the light

source for an infrared exposure with the sufficient effectiveness which cannot check the light source by looking by this invention so that clearly.

[Translation done.]

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TECHNICAL FIELD

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PRIOR ART

[Description of the Prior Art] The light is reflected and what carried out the laminating of the metal and semi-conductor which have what carried out the laminating of a high refractive-index transparence dielectric and the low refractive-index transparence dielectric by turns, and the property to reflect the light in the interference filter which penetrates infrared radiation, and the transparence dielectric by turns is known. Among these, the cold mirror which used silicon (Si), a silicon dioxide (SiO2), and/or magnesium fluoride (MgF2) is known as an interference filter which carried out the laminating of a metal and a semi-conductor with the property to reflect the light, and the transparence dielectric, by turns (JP,6-167604,A). This cold mirror is a thing using the property to reflect the light of silicon, and has obtained 20% or less of reflection factor in the infrared region of 80% or more of reflection factor, and 800-2000nm range in the light of 430-675nm range by the laminating of 16 or less layers.
[0003] If absorption of a silicon layer is disregarded when seeing from the reflection factor of the above-mentioned cold mirror and it is going to use this as a filter for the black lights, it can say that it has 80% or more of permeability in the infrared region of 800-2000nm range, and will have 20% or less of permeability in the light of 430-675nm range. When it is going to use this as a filter for the black lights and the light source is seen through a filter, with the naked eye, it spaces and the light source will be in the so-called condition of being visible, and the permeability of the light is too high to use. Although this is also considered that the limitation was generated in design by having made into quarter-wave length optical thickness of each class which constitutes the interference film, it is seen from the purpose of use and considered to be sufficient thing with such a configuration.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] This invention tends to obtain 0.1% or less of filter an average of 80% or more by within the limits whose permeability of a visible ray is 400-800nm in the range whose infrared permeability which can be used as the infrared exposure light source (black light) is 900-1500nm.

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MEANS

[Means for Solving the Problem] The visible-ray cutoff infrared transparency filter of this invention One [at least] field is made to carry out the laminating of the high refractive-index layer which consists of semi-conducting material, and the low refractive-index layer which consists of a transparence dielectric by turns, while on the rear face of front of substrates, such as glass, a quartz, and plastics. By multilayers interference It is the filter which intercepts the visible ray from the light source and penetrates infrared radiation, and the above-mentioned semi-conducting material is silicon or germanium, and the quality of the materials of a low refractive-index layer are a silicon dioxide, magnesium flux, etc., and are characterized by the point which made the number of cascade screens 17-45 layers. And it can consider as 0.1% or less an average of 80% or more by this configuration in the range whose infrared permeability is 900-1500nm by within the limits whose permeability of a visible ray is 400-800nm, and it becomes possible to acquire the infrared exposure light source which cannot check the light source by looking combining the light source.
[0006]
[Embodiment of the Invention] Drawing 1 is the example which arranged the cylindrical shape filter 2 in the surroundings of the halogen lamp 1 which is the light source, and the laminating of the above-mentioned visible-ray cutoff infrared transparency filter 22 is carried out to the front face of the substrate 21 of the cylindrical shape produced with the ingredient with which this cylindrical shape filter 2 penetrates proper infrared radiation, such as glass, a quartz, and plastics. In this case, a filter may not be prepared in the perimeter side of the light source, but may be prepared only in the front parts of the light source and a reflector. Drawing 3 is the example to which the front face of a halogen bulb 1 was made to carry out the laminating of the above-mentioned visible-ray cutoff infrared transparency filter 22 directly.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the fragmentary sectional view showing one example of the method of equipping with the light source of the visible-ray cutoff infrared transparency filter of this invention.
[Drawing 2] It is the conceptual diagram showing one example of the configuration of the visible-ray cutoff infrared transparency filter of this invention.
[Drawing 3] It is the side elevation of the light source lamp in which other examples of the method of equipping with the light source of the visible-ray cutoff infrared transparency filter of this invention are shown.
[Drawing 4] It is the graph which shows the part light transmission property of the visible-ray cutoff infrared transparency filter of this invention.
[Description of Notations]
1 Halogen Lamp 2 Cylindrical Shape Filter
21 Substrate 22 Visible-Ray Cutoff Infrared Transparency Filter

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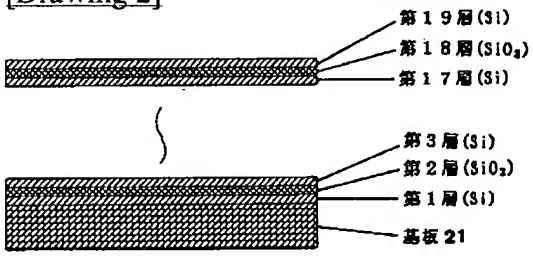
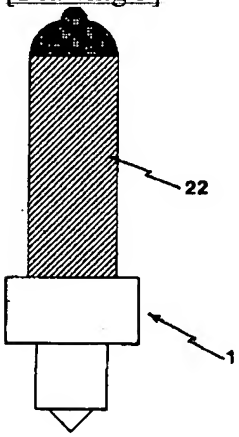
DRAWINGS

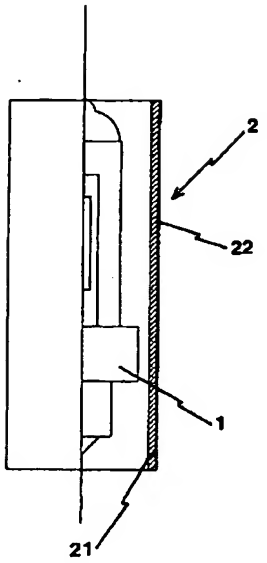
[Drawing 2]



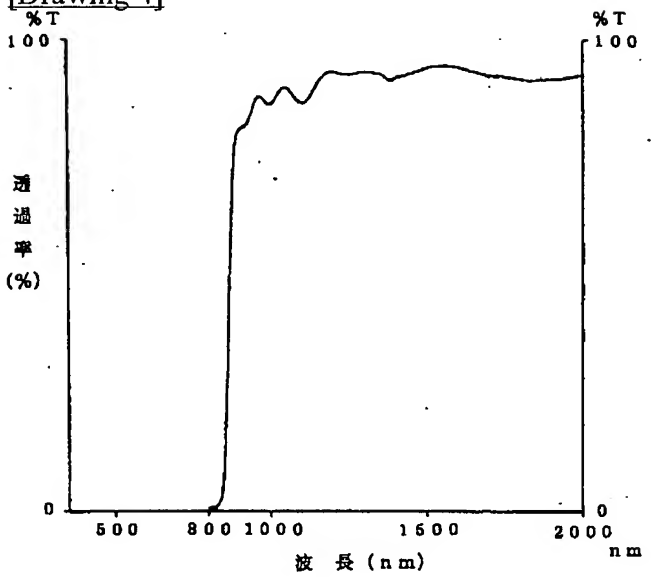
[Drawing 3]



[Drawing 1]



[Drawing 4]



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